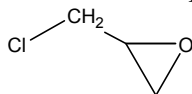


**EPICHLOROHYDRIN**  
**CAS No. 106-89-8**

First Listed in the *Fourth Annual Report on Carcinogens*



## CARCINOGENICITY

Epichlorohydrin is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC V.11, 1976; IARC S.4, 1982; IARC S.7, 1987). When administered by gavage, epichlorohydrin induced carcinomas and papillomas of the forestomach in male rats. When administered by inhalation, the compound induced carcinomas and papillomas of the nasal cavity in male rats. Subcutaneous injection of epichlorohydrin produced local sarcomas in female mice. Epichlorohydrin also was active as an initiator in a two-stage skin carcinogenesis study of female mice, but did not induce tumors when applied alone to the skin.

There is inadequate evidence for the carcinogenicity of epichlorohydrin in humans (IARC V.11, 1976; IARC S.4, 1982; IARC S.7, 1987). One study of factory workers exposed to epichlorohydrin shows a significant excess of respiratory cancer. However, some of the workers may have also been exposed to diisopropyl sulfate.

## PROPERTIES

Epichlorohydrin is a colorless liquid with an irritating, chloroform-like odor. It is slightly soluble in water; miscible with ethanol, diethyl ether, and chlorinated aliphatic hydrocarbon solvents; and insoluble in petroleum hydrocarbons. Epichlorohydrin hydrolyzes slowly at room temperature and more rapidly in the presence of heat or traces of acid. When heated to decomposition, epichlorohydrin emits toxic fumes of hydrochloric acid and other chlorinated compounds. The commercial product is 98% pure with a maximum of 0.2% water.

## USE

Epichlorohydrin is used in the production of various synthetic materials, including epoxy resins (68% of the epichlorohydrin produced), synthetic glycerin (19%), elastomers (3%), and others (10%) (NCI DCE, 1985f). Other products produced from epichlorohydrin include glycidyl ethers, some types of modified epoxy resins, wet-strength resins for the paper industry, and water-treatment resins. It has been used to cross-link starch in food (IARC V.11, 1979). Epichlorohydrin is also used in the production of Zeospan, a specialty polyether rubber used for car parts (Chem. Week, 1986b). There is widespread use of epichlorohydrin as a stabilizer.

## PRODUCTION

The 1998 *Chemical Buyers Directory* identifies 19 U.S. suppliers of epichlorohydrin, and *Chemycyclopedia* 98 names five suppliers (Tilton, 1997; Rodnan, 1997). The 1997 *Directory of Chemical Producers* lists two domestic producers of the chemical, with a total output of 725 million lb (SR1a, 1997). The USITC has listed two companies producing undisclosed amounts of epichlorohydrin since 1980 (USITC, 1981-1991, 1993-1995). The Chemical Economics Handbook, however, has provided production and import and export data through 1989 (SR1c, 1991). In 1989, 495 million lb of epichlorohydrin were produced in the US with 18 million lb imported and 60 million lb exported (SR1c 1991).

## EXPOSURE

The primary routes of potential human exposure to epichlorohydrin are ingestion, inhalation, and dermal contact. Levels of epichlorohydrin in food, food additives, or food packaging are so low that the potential daily intake through ingestion is minimal. According to FDA, epichlorohydrin is no longer used in the starch industry. Occupational exposure is possible during its production and during the synthesis of its end products. Evidence suggests that epichlorohydrin is readily absorbed when ingested or inhaled and that it is a systemic poison when absorbed through the skin (NCI DCE, 1985f; NIOSH 30, 1978). The National Occupational Exposure Survey (1981-1983) indicated that 3,306 workers, including 558 women, potentially were exposed to epichlorohydrin (NIOSH, 1984). This estimate was derived from observations of the actual use of the compound (80% of total observations) and the use of tradename products known to contain the compound (20%). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 41,380 people in 58 different occupational categories were potentially exposed to epichlorohydrin in the workplace. This estimate was based only on actual observations of the use of the compound and tradename products containing or suspected of containing the compound (NIOSH, 1976). Comprehensive industrial surveys conducted for NIOSH included five facilities: two manufacturing epichlorohydrin and three producing epoxy resins and glycerin. The survey results suggested that chemical operators at these plants had the greatest potential for exposure to epichlorohydrin. Time-weighted averages (TWAs) ranged from nondetectable to 2.1 ppm in the two manufacturing plants and from nondetectable to 0.83 ppm in the resin production plants. A limited number of samples also indicated a relatively high potential for epichlorohydrin exposure for shipping workers in the epichlorohydrin production plants (0.06 to 0.28 ppm TWA) (NIOSH Tech. Rep., 1978; NCI DCE, 1985f). The ACGIH (1986) recommended threshold-limit value (TLV) TWA is 2 ppm (8 mg/m<sup>3</sup>) with no skin contact.

The Toxic Chemical Release Inventory (EPA) estimated that 353,964 lb of epichlorohydrin were released to the environment from 48 facilities that produced, processed, or used the chemical in the United States in 1996. Of that total, 93.5% was released to air, 5.9% to water, and 0.6% to land. A facility located in Freeport, Texas, reporting under industrial classifications for manufacture of alkalis and chlorine (SIC Code 2812), industrial gases (2813), industrial inorganic chemicals (2819), plastics materials and resins (2821), industrial organic chemicals (2869), and adhesives and sealants (2891), accounted for 41.4% of the total air emissions and 91.6% of the total water release (TRI96, 1998).

## REGULATIONS

EPA regulates epichlorohydrin under the Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Food, Drug, and Cosmetic Act (FD&CA), Resource Conservation and Recovery Act (RCRA), Superfund Amendments and Reauthorization Act (SARA), and Toxic Substances Control Act (TSCA). EPA is considering regulating epichlorohydrin under the Clean Air Act (CAA). A reportable quantity (RQ) of 1,000 lb was established for epichlorohydrin under CWA, but a final rule RQ of 100 lb has been established under CERCLA. Epichlorohydrin is regulated by EPA as a toxic inert ingredient in pesticides under FD&CA. It is listed as a toxic hazardous substance under RCRA and SARA, and it is subject to reporting rules under TSCA. FDA regulates epichlorohydrin as a food additive. NIOSH has recommended that epichlorohydrin be treated as a human carcinogen, that exposure be limited to the lowest level possible, and that skin exposure be avoided. OSHA has amended the PEL to 2 ppm as an 8-hr TWA. OSHA also regulates epichlorohydrin under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-58.